



MEETING ENVIRONMENTAL REQUIREMENTS WHILE IMPROVING PLANT ECONOMICS—THE NOXSO PROJECT

Project Description

America's coal resources are far greater than the entire world's supply of oil. The only barrier to increased use of these resources is the impact that coal can have on the environment. The NOXSO project is demonstrating at a 150-megawatt Alcoa generating plant how an easily retrofitted technology can eliminate this barrier. The NOXSO technology reduces sulfur dioxide (SO_2) emissions by 98% and nitrogen oxides (NOx) emissions by 75%, while allowing use of a low-cost, high-sulfur coal and creating a revenue-generating sulfur by-product in place of waste.

Compliance with environmental requirements and improved power-generation economics are achieved simultaneously. By participating in this project, Alcoa not only meets the requirements of the 1990 Clean Air Act Amendments, but takes advantage of the U.S. Environmental Protection Agency's (EPA's) SO₂ Allowance Trading Program. It is one of the first industrial units to do so. It will generate revenues from SO₂ allowances as well as from the sale of liquid SO₂ produced from sulfur by a burn-in-oxygen technology piloted by Calabrian Corporation. The by-product can be sold in quantities of up to 45,000 tons a year.

The project lowers plant operating costs in other ways, too—the project site, Alcoa's Warrick Unit #2, burns 500,000 tons per year of low-cost, high-sulfur coal, of which Indiana has reserves in excess of 675 million tons. Furthermore, the ${\rm SO}_2$ and ${\rm NOx}$ are removed simultaneously in one vessel, unlike conventional processes that require investment in separate vessels.

The process itself is simple: the technology is installed downstream of the combustor's particulate removal system, in the flue gas stream. The flue gas contacts a fluidized bed of sorbent (a sodium carbonate impregnated alumina bead developed and patented by NOXSO), which adsorbs both SO₂ and NOx. Saturated sorbent is removed from the adsorber and heat-treated to remove NOx, then treated with natural gas to remove SO₂. The regenerated sorbent is recycled for reuse. An environmentally superior new process produces liquid SO₂. Neither the NOXSO nor the burn-in oxygen technologies produce any waste by-products.

Program Goal

The NOXSO project has direct reference to the goal of the Clean Coal Technology Program: to facilitate commercialization of advanced coal-based technologies and develop opportunities for economic growth and export. It demonstrates how the efficiency and environmental performance of coal-fired power-generating systems can be increased to make them highly profitable, and to put them into compliance with the most stringent environmental regulations in the world.

PRIMARY PROJECT PARTNER

NOXSO Corporation Bethel Park, PA

MAIN SITES

Alcoa Generating Corporation Newburgh, IN

Olin Corporation Charleston, TN

TOTAL ESTIMATED COST

\$82,800,000

COST SHARING

DOE \$41,400,000

Non-DOE \$41,400,000

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CONTACT POINTS

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Project Partners

ALCOA GENERATING CORPORATION (technology demonstration site)

OLIN CORPORATION

(liquid SO₂ production site)

STATE OF INDIANA

(issuing and guaranteeing revenue bonds)

GAS RESEARCH INSTITUTE (cofunding)

ELECTRIC POWER RESEARCH INSTITUTE (cofunding)

W.R. GRACE & COMPANY (cofunding)

SOUTHERN INDIANA GAS AND **ELECTRIC COMPANY** (cofunding and plant operation)

MORRISON KNUDSEN-FERGUSON **G**ROUP

(engineering)

PROJEX

(construction management)

CALABRIAN CORPORATION (SO₂ burn-in-oxygen technology)

ADVANCED PETROGAS SYSTEMS (SO₂ production fabrication)

Project Benefits

The NOXSO project demonstrates on a 150-megawatt scale how environmental compliance can be combined with other cost savings to offer optimal power generation economics. It combines the first commercial installation of the NOXSO process with the first demonstration of the Calabrian burn-in-oxygen liquid SO₂ production process. While using low-cost, high-sulfur fuels, the system slashes SO₂ and NOx emissions to comply with stringent environmental regulations and gain allowances in EPA's SO₂ Allowance Trading Program. This is the major benefit of the NOXSO technology, but there are others. The process creates no waste, only a saleable liquid SO₂, produced at the Olin Chlor-Alkali Plant in Charleston, Tennessee.

The key advantages of this system include:

- Removal of 98% SO₂
- Removal of 75% NOx
- Production of 45,000 tons of marketable liquid SO₂ per year
- Eligibility for EPA SO₂ allowances
- · Zero waste
- · Continued use of low-cost, high-sulfur fuels
- · Compatibility with all combustor systems
- · Convenience of retrofit and small footprint
- Economic superiority to conventional processes
- Retention of 50 coal-mining jobs and provision of 200 construction jobs

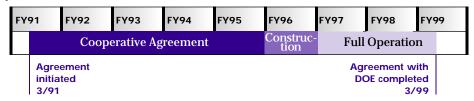
As an example both of successful export of the system and of its cost-effective application at a small facility, the process is also being demonstrated offshore in an installation on a 12-megawatt boiler (thermal) at the Technical University of Denmark in Copenhagen.

Cost Profile (Dollars in Millions)

	Prior Investment	FY95	FY96	FY97	Future Funds
Department of Energy *	\$2.5	\$3.0	\$28	\$2.3	\$5.6
Private Sector Partners	\$2.5	\$3.0	\$28	\$2.3	\$5.6

^{*} Appropriated Funding

Key Milestones



NOXSO and Alcoa operations agreement ends 2010